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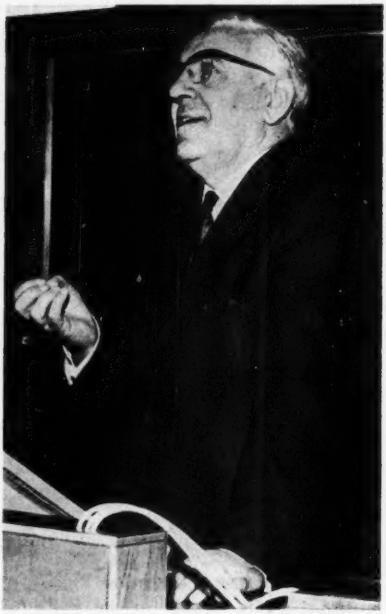
Director General, A.D.A.S.



Sir Emrys Jones addressing farmers at the A.D.A.S. seminar at Lancaster University

It was perhaps inevitable that the apparent demise of N.A.A.S. and the complete shakeup of all the Ministry's advisory services would be greeted with gloom, not only by the farming community but by a fair proportion of the advisory staff themselves. This was a tribute to the favourable reputation which the individual services had built up over the years and reflected the pride that the professional staff had in belonging to those services. I and others have already explained why these changes had to be made; but it needs to be said now that although A.D.A.S. came into force on 1st March 1971, neither the new organization nor the new cost-conscious group approach could take effect overnight. The changes were too big for that and have to be implemented gradually. But in the midst of change advisers have been quietly getting on with the job.

Now that the dust is settling it is appropriate to look in some detail at what this job is: the organization and the philosophy provide the framework within which we work, but the important thing is what we do, and what we are planning to do in the future.

A.D.A.S. provides advice for all sectors of the agricultural industry. It combines the basic sciences and technical development with field observation and practice and communicates the results to the industry in order to help increase productivity; A.D.A.S. is also concerned with a wide range of statutory functions in both urban and rural communities ranging from flood prevention schemes to those affecting public health, e.g., tuberculosis, brucellosis, milk and dairy regulations and so on. In addition it is directly involved in a number of broad issues concerning modern agriculture and its effect on the environment as a whole.

The soil

The soil is the basic raw material of the industry that links many of the activities of the combined Service. The extensive knowledge and understanding of soils within the Service exceeds that of any other organization and without it the recent report of the Agricultural Advisory Council *Modern Farming and the Soil* could not have been produced. Then there is the mammoth task of classifying agricultural land on a scale of 1 in. to the mile: this is now approaching the half way stage and should prove an invaluable guide to the planner, the industrialist, the farmer and the urban dweller in making the most of this vital resource.

Adequate *drainage* of the soil is of course an essential pre-requisite for most types of farming and the advent of a unified Service has strengthened the link between the agricultural land use requirements connected with field drainage schemes right through subsidiary drainage schemes to main river schemes. This is a fundamental chain of events that will be of great benefit to the industry. Work on new techniques and materials continues at the Field Drainage Experimental Unit and a draft British Standard will be published very shortly as a result of the extensive work they have done on the use of plastics.

A.D.A.S. soil scientists are being increasingly involved with all the chemical and physical factors of soils which relate to the optimum use of land for different purposes whilst rapid developments in the laboratory automation of soil analysis could lead in the foreseeable future to the results becoming instantly available via direct computer links.

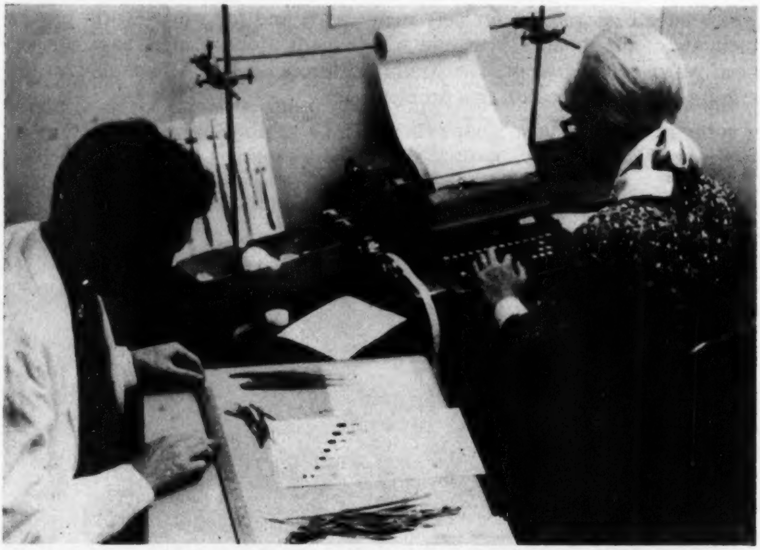
Crops

Crop response is of course highly inter-related with soil type, drainage and nutrient levels. Work on the Fen and shallow chalk soils by A.D.A.S. soil scientists has led to the recognition that copper deficiency could be a cause of serious crop losses. A.D.A.S. also plays its part in the wide ranging programme conducted annually to examine new varieties of crops and grass that might be of benefit to the industry. Although higher yields are an eternal quest, the gap between performance and potential is one of the main problems on which A.D.A.S. must concentrate its forces in the next few years.

The husbandry and hygiene of modern crop production demands protection of a high order, but in our efforts to encourage higher yields and better quality plant material we have also to protect the consumer from any deleterious effect of chemicals used in the process. The Plant Pathology Laboratory is the clearing house for information on the toxicity of pesticides and herbicides to man, animals and plants and is continually collecting information on the usage of these materials in agriculture and horticulture.

A.D.A.S., and before it N.A.A.S., have been world pioneers in the assessment of pest and disease by intensive survey work—work that would have been impossible for any other organization without these facilities, coverage and close farm contacts. Recent work of A.D.A.S. plant pathologists on barley leaf diseases is likely to become a classic. Although initially intended to discover the importance of rhynxchosporium, it revealed the enormous and irregular losses due to mildew and the occasional importance of yellow and brown rusts. Although work on systemic fungicides was already in progress, there can be little doubt that these results gave a great fillip to research by providing an unexpectedly large market. The Ministry's advisory services

have long been interested in forecasting the likely incidence of pests and diseases both for optimum timing of treatments and in the longer term, and A.D.A.S. entomologists are collaborating with the Imperial College in a new look at forecasting bean aphid attacks based on a study of winter and spring populations of their alternative host, the spindle tree.



Examination of sample taken in one of the barley surveys, and recording of data for computer at Plant Pathology Laboratory

Drainage and irrigation

Crop response is also dependent on the moisture regime within the soil in which it grows, and the last two decades have seen the renaissance of irrigation which now extends to nearly a quarter of a million acres in this country. Grant aided water supplies are not, however, confined to irrigation purposes, and A.D.A.S. staff in the Drainage and Water Supply and Veterinary Arms have been particularly active in expanding the network of piped drinking water for stock in order to reduce the hazards to animal health of drinking from open streams and ponds.

Livestock

The animal health interests of the combined Service have of course many ramifications. Brucellosis eradication is under way and over the next decade this will be one of the main tasks of the Veterinary Arm. Although costly in terms of money and manpower, there seems no reason to think that it will be any less successful than those major eradication programmes of the past that have brought under control bovine tuberculosis and swine fever. The Investigation Laboratories are constantly monitoring the level of disease present in livestock carcases received for pathological examinations: this information enables us to assess the economic significance of a disease and provides a basis for planning its control and, if necessary, eradication.

The very successful Pig Health Scheme has reached its limit of 300 breeding herds and the wider objective now is to interest pig breeders in general to follow the patterns of disease control established within the Scheme using their own resources. Whilst new and emerging problems must receive attention, their importance must be kept in perspective as the major causes of loss or lowered production are attributable to pathological conditions which have been present for very many years and for which world proven methods of prophylaxis exist and which many stock owners have not yet been persuaded to accept. The combined forces of A.D.A.S. should ensure a more effective attack on this problem area.

Post mortem examination of sheep carcase

The nutrition of our livestock is of considerable economic significance both from the point of view of the welfare of the individual animal and for the success of commercial livestock enterprises. Pioneer work by A.D.A.S. microbiologists has shown the potential importance of mycotoxins in animal feeds, and major advances have also been made on the feeding value of hays by carrying out digestibility trials on the Ministry's Experimental Husbandry Farms. Much sounder advice can now be given on the role of hay in winter feeding, and the work is being extended to silages and other bulky feed.

Studies have recently been made on the application of linear programming and other computer techniques to the development of least cost rations. New knowledge of mineral and amino acid requirements for various classes of stock is gradually making manual calculations tedious and impracticable, and the introduction of computer terminals at regional centres could provide a rapid means of deciding on complex mixtures to suit specific or general situations.

A.D.A.S. microbiologists are also active in farm waste disposal research. Their investigation into the economic recycling of wastes will be of increasing importance if we are to come to terms with the threat of pollution and increasing urban pressures.

Environmental control

Finally, a word about the environmental commitments of A.D.A.S. The Countryside Commission carries many of the major responsibilities for this subject and the Lands Arm is co-operating in one of their newer research projects on the establishment of 'New Landscapes'. They are also co-operating with the Commission in two upland management experiments, one in Snowdonia and the other in the Lake District. The Department of the Environment and the Council of Industrial Design are also concerned with the conservation of visual amenity and consult A.D.A.S. when setting standards for building design, colour, situation and materials within the agricultural industry. As a follow-on from Conservation Year, A.D.A.S. is continuing to help the Nature Conservancy promote the right balance between the flora and fauna of the countryside and the demands of commercial agricultural production.

Conclusion

With the formation of A.D.A.S. we have established a quite unique organization which has the professional, scientific and technical knowledge necessary to assist all the sectors of the agricultural industry in this country. It combines several scientific disciplines with a whole range of technological capabilities directly related to the emerging problems of modern agriculture. It is thus singularly well equipped to communicate the results of science and technology to the industry, and to do so in the ways now decided upon so as to make an even greater impact upon the industry's productivity than the separate services have been able to do in the past. The increasing amount of group activity which I have already referred to will mean that broader cross-sections of the industry will be able to study the scientific and technical information given at these sessions. For example, A.D.A.S. is promoting a series of events up and down the country designed to identify those problems likely to face farmers in the 70s and the seminars held at the universities of Lancaster and York in September last were examples of the way in which A.D.A.S. will meet with its customers in the future. The basic reason for the existence of A.D.A.S. as an advisory service is to secure improvement in the industry's productivity by providing a continuing source of professional, scientific and technical information to the industry as a whole, to farmers in groups and to farmers as individuals. In the years immediately ahead this function will have a special significance in that the Service must gear itself to provide the most effective extension information to enable the British farmer to compete effectively in a European context.

New Developments in Sheep Husbandry

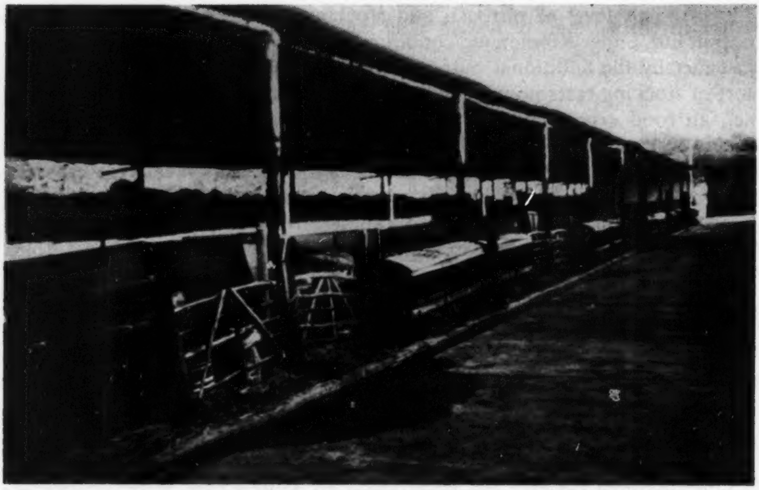
J. S. Broadbent

SHEEP farmers have been under economic pressure for several years. From the peak of over 14½ million breeding ewes and shearlings in Britain in 1966 the number slipped to less than 13 million in 1970. Sheep have been severely reduced in many lowland counties to make way for arable cropping, whereas in the hill and upland areas there has tended to be less variation in numbers. Thus, it is true to say that the hill and upland areas are now carrying a much higher proportion of our total sheep stock than they were five years ago. However, this is by no means a static situation. Many lowland farmers who have turned to continuous cereal farming are coming to realize that falling yields, pests, diseases and rising costs are seriously reducing profits on many poorer soils. This situation has led to renewed interest in break crops of all types, some of which could well be utilized by sheep. We could see more sheep in the lowlands again in the next year or two—not necessarily breeding ewes but perhaps store lambs for finishing in the autumn and winter.

Limiting factors

Against this background of economic pressure there have been many changes in attitudes towards sheep husbandry and in the techniques employed. Advisers are now more aware of the factors limiting production. On the smaller farms, of course, it is usually land availability which imposes limitations on production; output per acre is of prime importance. On other farms it may be labour and this is particularly true on hill farms where output per man can be of overriding importance. Similarly, there are circumstances where capital is the restricting factor, a situation which demands special steps to ensure the maximum return from the capital employed. A successful sheep enterprise must therefore be geared to increasing the profit within the available resources of land, labour and capital.

One obvious way to increase profitability is to increase output—per ewe or per acre, possibly both. A great deal of time and effort have been expended in recent years in making traditional systems of sheep husbandry more profitable—in supporting each part of a system in order to make the whole substantially more profitable. Economic surveys of groups of flocks, often in the same area, show tremendous variability in profitability which exists between flocks—variability which can be attributed only to management. It is quite usual to find that the most efficient flocks compare more than



Inexpensive wintering accommodation at Rosemaund Experimental Husbandry Farm. Note provision for good ventilation and use of poles for construction of main frame

favourably with possible alternative enterprises, particularly in relation to capital employed. It is the average and below-average flocks which present the problems.

Output can be increased by several methods: physical output can be improved by increasing stocking rate or lambing percentage, or possibly by later lambing. Financial output can be improved by better marketing, marketing at a different season or marketing lambs at a different weight.

Stocking rate

It used to be said that 'a sheep's worst enemy is another sheep', which implied that sheep could be run successfully only at low stocking rates. It is still true that generally, as stocking rates increase, so individual animal performance falls. However, there have been some advances in recent years which demonstrate how the effects of this decline can be kept to a minimum. It is now a question of setting targets for the most profitable level of output.

Associated with any consideration of stocking rate is the level of nitrogen application to pastures. Not long ago sheep and fertilizer nitrogen were considered to be incompatible but recent work at Ministry experimental husbandry farms, notably Rosemaund and Drayton, has shown that sheep on grass which received up to 240 units of nitrogen per year suffer no ill effects due to the nitrogen. The experiments showed that, in most years, at any of three levels of nitrogen used (0, 90 or 180 units), total output of lamb per acre increased as the stocking rate increased. At any given level of stocking, however, extra nitrogen did not increase lamb output, it merely provided more grass for conservation.

From the Rosemaund work, dealing with rotational paddock grazing of long term leys, it has been concluded that the optimum return is from grassland given about 100 units of nitrogen per acre and stocked at six ewes per acre (at Rosemaund these were Welsh half-bred ewes weighing about

130 lb). This level of nitrogen and stocking does not give the maximum output but, under Rosemaund conditions, the cost of further nitrogen is only just met by the additional output. This example gives an indication of the sort of stocking rates now being operated successfully on a year round basis, i.e., all food except concentrates being grown on the area of land under consideration.

A high stocking rate and increased use of nitrogen often calls for a system of winter housing. As stocking rate increases, so, too, does the problem of poaching, especially in winter. Each ewe has 'five mouths' and thirty mouths to the acre is usually more than land can carry in a wet climate. There is also the problem of parasite contamination of the grass and this becomes greater as sheep are intensified. Hence there is a two-fold reason for keeping sheep off the grazing area during the winter.

Winter housing

Although housing sheep in winter is a practice dating back centuries in Iceland, Scandinavia and France, sheep were rarely housed in Britain until the last decade. At first the technique was treated with some scepticism; now it is accepted as an integral part of most heavily stocked grassland systems. It has been shown that housed sheep, provided they have plenty of ventilation and adequate feed, thrive well indoors. They do not necessarily suffer from the many diseases it was at one time feared they might when confined at close quarters. Provided a few basic rules are obeyed, successful sheep housing is easy and few shepherds who have lambed indoors would be anxious to return to outdoor lambing.

Mixed stocking

Many farmers have concluded that the problems of heavily stocked sheep-only systems present too much of a management headache. One way of overcoming some of the problems is to introduce cattle into the system. Mixed grazing systems, when well planned, can ensure some control of parasites and encourage more even grazing because one species will eat the grass rejected by the other.

A mixed grazing experiment at Trawscoed Experimental Husbandry Farm, where 4½ Welsh half-bred ewes have run with 1½ Hereford × Friesian heifers per acre, has shown how the two species can be complementary. The sheep have their maximum food requirements in the early part of the season—April, May and June—until lambs go away fat, while the young grazing cattle need a gradually increasing supply of herbage throughout the season, reaching a peak from July onwards. On this mixed grazing trial over 95 per cent of the lambs have gone fat each year by mid-August, compared with a steadily declining percentage of lambs fat on an equivalently stocked sheep-only system (down to 56 per cent in the third year). Grass was more efficiently used, needing far less mechanical topping than was the case with sheep or cattle only treatments.

This is not the only form of mixed stocking, of course. There are many permutations of the ratio of cattle to sheep, or they can graze alternately. A very profitable, though not really new, system is to run a limited number of sheep as scavengers behind dairy cows or heifers to clear any surplus grass.

These, then, are all factors which have helped to improve the output of sheep systems despite the inherent problems of intensification.

Lambing performance

In addition to the factors discussed above, there have been several attempts to increase the output of lambs per ewe. Better management of ewes at mating combined with a higher ratio of rams to ewes has resulted in a reduction in the spread of lambing time while minimizing the number of barren ewes. A further step which has been taken by some farmers is the use of hormones for the synchronization of oestrus. The object is to reduce the mating period to about two days, which should in turn reduce the lambing period to about a week. Unfortunately, results so far have been somewhat erratic but development work is continuing and we may yet see a reliable system produced at a reasonable cost. In all flocks such a system could be very effective in saving labour at lambing time.

Another development which is perhaps not far away is a method of determining the number of lambs being carried by a ewe fairly early in pregnancy. There have been many attempts to produce a satisfactory device for this purpose but the one which could find wide application would need to be relatively cheap, portable, effective and preferably simple enough to be operated by farm staff. The benefit afforded by such a machine would be enormous; ewes could be managed and fed according to the number of lambs they were carrying. This would enable much more effective use of food than at present.

A Finnish Landrace ram, representative of a breed characterized by very high prolificacy but lacking in milk and growth when compared with British Breeds

New breeds and crosses

Along with improvements in management, a number of attempts at genetic improvement have been made. The importation of foreign breeds

such as the Finnish Landrace, East Friesland, Ile de France and Oldenburg has increased the range of basic genetic material available to the enterprising breeder. Genetic improvement is a very slow process requiring thorough testing during the course of development. The experimental husbandry farms have been engaged in this test work. Results could be described as promising, with most of the new breeds and crosses showing some improvement over the experimental controls.

The problem facing breeders is to incorporate into the finished product as many of the advantages of the foundation stock as possible without any of the disadvantages. The Finnish Landrace, for instance, has a very high prolificacy coupled with very moderate milk yields, growth rate and carcase quality. It has been shown that high prolificacy is carried over into the crosses but work is in progress now to find the most suitable amount of Finnish Landrace blood required for crosses with our native breeds; we need to produce highly prolific ewes which milk well and produce lambs which grow quickly to give high quality carcases.

These new, or rejuvenated, methods are breaking down the barriers which have hitherto restricted flock output. As new techniques are developed they, too, can be incorporated into new systems of sheep husbandry after thorough testing at our experimental husbandry farms. Their acknowledged role in this field seems likely to become even more important in the future.

J. S. Broadbent, Ph.D., B.Sc., is a specialist in sheep husbandry with A.D.A.S. at Skipton, Yorkshire.

Report on Year Round Cauliflower Production

A report on year round cauliflower production in Lincolnshire, Kent and Cornwall in 1969/70 has been published by the University of Exeter. *

The report describes the pattern of seasonal production and each growing area's share of the early season, summer, autumn and winter heading crops, and reviews complementary and competing brassica crops and Channel Island and imported supplies. It looks at present trends in the level of supplies and relates them to the population increase, and also attempts some explanation of market price variations for cauliflower from season to season. It describes the results of a Survey of costs, returns and margins in the three counties in 1969/70, and these, and the main factors affecting them, are analysed for the various cauliflower types. The report concludes with an assessment of the future prospects of cauliflower production.

This study is the fifth in the series of co-ordinated economic investigations commissioned by the Ministry of Agriculture, Fisheries and Food which are being undertaken by university departments of agricultural economics and published under the title 'Agricultural Enterprise Studies in England and Wales'. The views expressed and conclusions drawn are not necessarily those of the Ministry.

The report brings together the results of a survey undertaken jointly by the University of Exeter, the University of Cambridge and Wye College (University of London) and co-ordinated by the University of Exeter.

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*Copies of *Year Round Cauliflower Production in Lincolnshire, Kent and Cornwall, 1969/70*, by Helen M. Cole, can be obtained from the University of Exeter Agricultural Economics Unit, Lafrowda, St. German's Road, Exeter, EX4 6TL, price 50p.

Farm Waste Disposal—
An international view

K. B. C. Jones

UNTIL recently, pollution was looked upon as a local problem with cause and cure in the hands of the same group of people. Yet modern society, in its search for wealth and prosperity, has harnessed the world's resources in such a way that both valuable minerals and pollution are carried across the globe with equal ease. We are all aware of oil and water pollution and the effect they can have on innocent peoples, perhaps even communities that do not enjoy the prosperity that brings pollution in its wake. Animal diseases know no political or economic boundaries, and it is sometimes difficult to contain outbreaks to restricted geographical areas.

If man is to preserve the quality of his environment, then pollution must be looked at on a world-wide basis. Agriculture is without doubt a significant offender in the pollution stakes but is not by any means the worst. Farmers have traditionally respected the countryside and the environment, and many of the technological changes that have come about have been forced upon them by economic circumstances rather than being adopted by choice. Agriculture has also made substantial efforts in the last decade to put its own house in order, and research, advisory effort and restrictive legislation have all contributed to a general improvement.

International symposium

Many problems are of an international character, and it is worth while occasionally to look at the methods and achievements of other countries to see if any lessons can be learned. Together with fourteen other research services and professional societies, the American Society of Agricultural Engineers and the Ohio State University held a 4-day conference earlier this year at Columbus, Ohio, on problems associated with livestock waste. The broad objectives of the conference were defined as being 'to bring together scientists, engineers, educators, public officials and industry representatives to discuss current research and development efforts: to evaluate current technology and to stimulate work in livestock management systems'. The symposium was not intended to be a session lamenting the complexity and magnitude of the livestock waste problem.

Over 700 delegates attended the conference, with U.S.A. and Canadian participants predominating. Eight European countries were represented—Russia, Rumania, Sweden, the Netherlands, Germany, England, Northern Ireland and Scotland. The delegates covered a wide range of academic disciplines but agricultural engineers (including farm building specialists), veterinarians, soil scientists and microbiologists predominated. In addition to participants from research and extension establishments, there were also a number of industrial sales and research staff representing manufacturers of equipment relevant to mechanical handling and sewage treatment processes.

One-hundred-and-four technical papers were read to the symposium at two simultaneous sessions and each group of lectures was followed by a generous discussion period. Recently a hard-backed book was published presenting the submitted papers in full*.

Lectures were given by representatives of most of the visiting countries as well as the host organizations. The aspects covered included waste disposal systems, beef feed lots, legal and administrative problems, physical and chemical characteristics, hydraulic transport, thermal drying, economics, land disposal, aerobic treatment and storage, re-feeding, and solid/liquid separation. In most cases several papers were presented under one subject heading so that a range of research and attitudes could be reported. All papers represented the personal views or findings of the speakers involved and not official, corporate or government policies. This led to a refreshing frankness of discussion.

Lessons learned

Although the member countries of the developed world have different climatic, land use and pollution problems, there are substantial areas of common interest and attitude. Everybody agrees that pollution is evil and that money and effort is required to maintain and improve the quality of the environment. There is concurrence that education and voluntary action is better than punitive legislation and that the worst kind of pollution is that which does permanent damage to plants or animals or which sterilizes soil or water. A basic framework of anti-pollution laws is of course necessary but little can be done without the co-operation of the public.

It is generally agreed that the best place for livestock waste is back on the land and that there should be some correlation between the area of land available for spreading and the number of livestock kept. This situation is easiest to achieve with cattle and sheep on a grass-based diet and most difficult with pigs and poultry which are housed throughout their lives and whose diet is based on bought-in rations. The economics of pig and poultry farming are such that a viable unit is inevitably a big one and not all producers are able or willing to buy sufficient acreage to bring equilibrium to their livestock unit. There are physical and financial constraints against land purchase, and the large farmer who holds his land free of mortgage is also the one who does not need to employ intensive methods to maintain a reasonable income.

All representatives at the symposium emphasized the need to restrict odours and to avoid upsetting non-agricultural neighbours. It was recognized that there is no simple physical or chemical antidote to odour problems but much could be achieved by good building design and siting, regular handling and a high standard of management. This includes the cessation of work during unfavourable weather conditions and a degree of public relations tactics in positively showing neighbours that all reasonable precautions are being taken to avoid nuisances being caused.

Research and development activities into improved methods of storage, handling and treatment are vigorous in most countries and no nation has any obvious lead over the others. There may be different emphasis on the

*Obtainable from American Soicety of Agricultural Engineers, P.O. Box 229, Michigan 49085, U.S.A., price $20.

relative importance of some aspects but this is justifiably accounted for by local geographical or economic conditions. The legislation in Britain and our programme of research and development work met with approval and it will be interesting to compare results in a couple of years' time. The conference emphasized yet again the need for a multi-disciplinary approach to waste problems, particularly in connection with ad hoc farm situations. The Americans are particularly good at the team approach; this is easy for them because teaching, research and agricultural extension are all based on the same university departments.

Waste treatment in practice

On the last day conference delegates were given the choice of visiting either two private farms, a state agricultural research centre, a sanitary engineering research station or an agricultural hydrological experimental station, each of which has carried out valuable research or development work into aspects of livestock waste management.

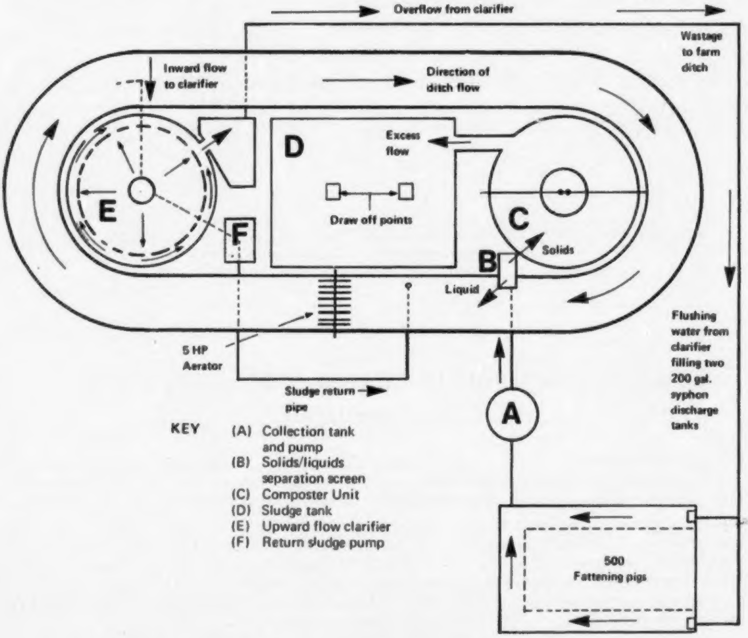


Fig. 1 Layout sketch of Pig Treatment Plant (not to scale). Some details of the plant are: Ditch 6 ft wide x 4 ft deep; Unit approx. 70 ft x 24 ft total; Clarifier 3 ft deep · upward flow design; Whole unit in-situ concrete.

One full-scale experimental unit demonstrated is of sufficient interest to be described here in greater detail. This was a treatment plant for the attempted biodegredation of the dung and urine from 500 fattening pigs where clarified liquid from the plant was returned to the building to flush down the dung channels. This saved manual cleansing and also diluted the incoming effluent to the treatment plant.

The basic layout is shown in Fig. 1. The oxidation ditch is typically oval-shaped with proprietary rotor. A sloping stainless steel screen filters out a high proportion of the gross solids before the liquid enters the ditch; it is rigidly fixed and liquid flows down its inclined surface from a header tank. The solids fall off the end of the screen direct into a composting chamber and the liquid fraction drops through the screen into the oxidation ditch. It is hoped that because of the initial solids/liquids separation the oxidation ditch itself will be free of sludge troubles. Excess sludge flows from the composter chamber to a central tank from which it is removed for field distribution. Treated liquid from the oxidation ditch flows to an upward flow clarifier with a central feed and perimeter discharge. Sludge is returned to the ditch immediately in front of the rotor and clarified liquid flows either to the piggery flushing tanks or, if surplus, to a farm ditch. The flushing tanks in the piggery each have a capacity of 200 gallons and are automatically emptied by syphonic action.

This treatment unit has similarities in concept to others which already exist or are proposed but it is one of the first where mechanical solids/liquids separation is being attempted before aerobic treatment and where the solids fraction may be rendered relatively innocuous by a digestion process. It is as yet too early to say whether the unit will be wholly successful or whether it could ever form the basis of a viable commercial unit.

K. B. C. Jones, B.Sc., A.R.I.C.S., is a Surveyor with A.D.A.S., London.

Cane Fruits – Fourth Edition of Ministry Bulletin now available

The third edition of Bulletin 156: Cane Fruits proved to be of considerable interest to growers and in the fourth edition *, published at the end of October, all previous information has been brought up-to-date and new information available from research stations included.

During the past few years there has been a revival of interest in planting not only raspberries but all cane fruits. The bulletin discusses all aspects of cane fruit production from the initial choice and preparation of the site to different methods of picking, grading and packing. There are detailed descriptions of specific varieties of raspberries, loganberries and blackberries, and particular mention is made cf Glen Clova, the new promising variety of raspberry bred at the Scottish Horticultural Research Institute.

The bulletin describes the pests and diseases to which cane fruits are subject and gives the latest advice on chemical methods of control. Information is also included about the machinery and implements used in cane fruit production. The bulletin concludes with a section describing the Certifications Schemes, the purpose of which is to ensure that carefully selected, healthy stock is available to growers. This will be a useful book of reference, especially to growers, advisers and students.

**Bulletin 156: Cane Fruits.* Fourth Edition, 1971. Price 40p (by post 42½p). Obtainable from H.M. Stationery Office or through any bookseller quoting SBN 11 241456 7.

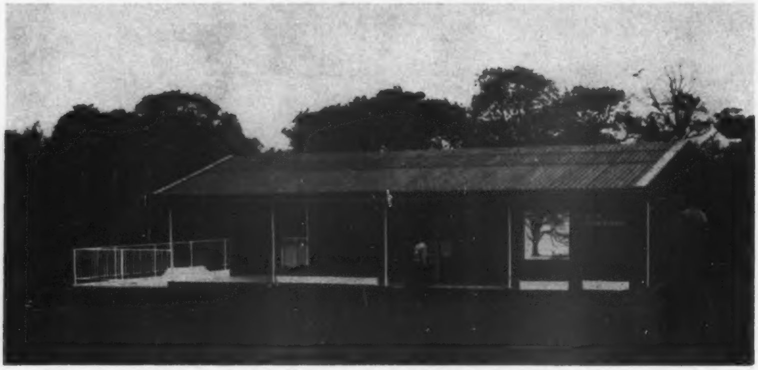
Farm Buildings

Partially slatted untethered dry sow stall house

This feature section contains articles by:

★ H. G. Penfold, A.R.I.B.A., Senior Architect and L. A. Waller, A.R.I.C.S., Farm Buildings Adviser, both with A.D.A.S., Leeds.

★ C. Dobson, M.Sc., A.R.I.C.S., Regional Farm Buildings Adviser with A.D.A.S., Reading.



Prefabricated farm building used for demonstration purposes

Off-the-Peg Farm Buildings

H. G. Penfold **L. A. Waller**

EVERYONE would like the best but usually only the rich can afford it. Being individualistic, the farming community wants the best of both worlds—a tailor-made building but at an off-the-peg price. Due to the efforts of designers and the competitiveness of manufacturers in the farm building field, farmers have, to some degree, had the best of both worlds.

Economic pressures, industrial rationalization and management considerations are forcing manufacturers to consider reducing the present range of their buildings and components. This could be achieved if all agricultural buildings were planned on the basis of standardized units, with the different elements of construction systematically related and every component conforming to an agreed dimensional order. An earlier article (*Agriculture*, December 1970 and January 1971) described the steps which the Ministry, in co-operation with other interested organizations, is taking to evolve a pattern of controlling dimensions and dimensional co-ordination for farm buildings. In the meantime, however, two changes have already taken place in the farm buildings industry; namely prefabrication and the growth of the package deal.

First prefabricated units

The term prefabrication is normally accepted as a form of construction in which units are manufactured in the workshop for rapid erection on the site. It may include parts or the whole of the structure of the building. Prefabrication is not new to the farm. The rural craftsman, for example, for

many years has prefabricated gates and mangers in his workshop for eventual use on the farm.

In the field of prefabricated structures a big step forward was taken after the Second World War with the introduction of buildings designed by the then Ministry of Agriculture and Fisheries which were allied to the policy of a permanent increase in food production at a time of shortage of labour and materials.

These buildings consisted of a limited range of standardized concrete stanchions and steel roof trusses with a few other components which were capable of being adapted to the many needs of the farmer, and gave some scope for original design; they could be erected with the minumum of skilled labour. With the introduction of this scheme in 1949 it was thought that this standardization of the building frame was only the first step and it was hoped that later it might be possible to introduce a number of other standardized components. Not only would this lead to a further saving of time, labour and materials, but ultimately to reduced costs. While manufacturers accepted the standard dimensions of the Ministry of Agriculture and Fisheries buildings where applicable, little immediate progress was made in the field of standardizing other components.

The farming industry from then until now has had great benefit from these first steps in prefabrication, whether the structures be in steel, concrete or timber, and one of the objectives envisaged at the outset, viz., a reduction in cost, has been achieved. It is generally acknowledged in the construction industry that the covering, that is the frame, roof and wall sheeting, provided for farm buildings is the most economical at present available. More recently, prefabrication has been taken a stage further by some manufacturers who have developed individual standardized components such as wall panels, partitions and pen fronts. Great strides have been made, particularly in the field of pig, poultry and cattle housing.

Dimensional co-ordination

The foregoing developments and the acceptance by farmers of proven space requirements and environmental conditions as an aid to good husbandry practice has enabled some manufacturers to produce a small range of completely prefabricated units. The tendency has been for these prefabricated buildings to be individualistic, in that each manufacturer has tended to produce his own closed system, that is one not interchangeable with other systems.

The step which the Ministry is taking to sponsor co-ordination of dimensions for farm buildings will, it is hoped, overcome this problem in time, but the farmer need not be directly concerned with how the industry finally organizes itself. What is of concern to him is the service he can obtain. Because of the competitiveness in the field, the farmer has up to the present time been well served by the farm buildings industry. Generally this has applied to the prefabricated aspects of the building frame and cladding; the associated work in walling, flooring and fitting out the building, however, has usually had to be carried out by a local building contractor or by the farmer carrying out some of the work himself. This has involved the farmer in a considerable amount of work in obtaining tenders and dealing with a number of contractors and the organization needed to complete the particular project.

Although in many cases this proved to be an exasperating exercise, provided the building was relatively simple it was within the capabilities of the farmer, with perhaps such advice as he could obtain from the Ministry's advisory service. With the reorganization of the advisory service the farmer will, however, in future have to become more self-reliant in these matters.

Package deals

What, then, are the alternatives available to the farmer? He can employ a professional man, whether he be an architect, surveyor or farming consultant, to co-ordinate the building processes on his behalf. Or he can decide to purchase a package deal building.

Package deal describes a style of operation whereby a comprehensive service is offered taking into account the statutory requirements of grant aid schemes and covering finance, supply and assembly of the structural frame and components with general organization and supervision of the building operations to their completion.

Much has been written of the advantages and disadvantages of the package deal service. In the matter of costs, obviously the overheads in co-ordinating the services are bound to be included, although possibly hidden, in the final figure. Against this the manufacturer offering a package deal has considerable expertise in his design and construction management which may achieve speedy erection and completion together with a consequent saving in cost when compared with the other alternative.

Future developments

One of the disadvantages in the past has been the difficulty the farmer has had of making the right choice of building suitable for his particular needs. With the experience gained by the manufacturers, problems such as this have now been largely overcome. It is still, however, important for a prospective purchaser to decide which building and manufacturer is most likely to meet his requirements. This involves a close study of the literature produced by each manufacturer and inspection of the various examples of structures already erected, coupled with enquiries about the day-to-day performance of the building in use. Constructional and design aspects must not be overlooked during this initial investigation. The work being carried out by the National Agricultural Centre in the demonstration areas at Stoneleigh enables the farming community to inspect a range of package deal buildings and components in a situation closely related to farming conditions. This type of work is most important as it enables the farmer to carry out an objective survey of the types of building available over a wider field. On the general question of research and development, it has been suggested that it would be a great help to the manufacturers and users of farm buildings if an independent co-ordinating body of research and development could be established. Even if this were possible some time would necessarily elapse before any significant results could be reflected in improved farm buildings.

However, on the continent of Europe an agricultural development company with a team approach is marketing a lightweight prefabricated building

system. It also undertakes planning, looks after the building permission procedure, makes application for all necessary finance, arranges with the manufacturers for supply and assembly and is responsible for organization and general supervision of the building operations. The success of this company, whose aim is the common good, is a practical demonstration of the value of the team approach allied to a developed prefabricated building system marketed with a first rate package service.

If the forecast that package deal farm buildings will make up 90 per cent of all buildings erected on farms in this country after 1980 is likely to become a reality, the agriculturists, scientists, professions and manufacturers may well have to give serious thought to the introduction of a similar system of team approach to the problems of prefabricated and package deal buildings. This will ensure that technical development and co-ordination will lead to providing the farmer with the complete service he needs at a price which he can afford and which his acceptance of the advantages of these types of tested buildings entitles him. By such means the best available buildings at off-the-peg prices could then well become a reality.

★ ★ ★

Farm Buildings Pocketbook

A new edition of this popular pocketbook—in metric—will be published shortly. It will contain much useful data and advice about farm building standards, dimensions etc.

Publication of the new edition will be announced in a future issue of *Agriculture* (Ministry Publications).

Housing the Sow and Litter

C. Dobson

In recent years there have been a number of developments in the housing of sows and litters and from a technical aspect there are many reasonably efficient methods. A typical 'decision tree' showing the main options for the conventional and the farrow to finish systems is shown in Fig. 1 below.

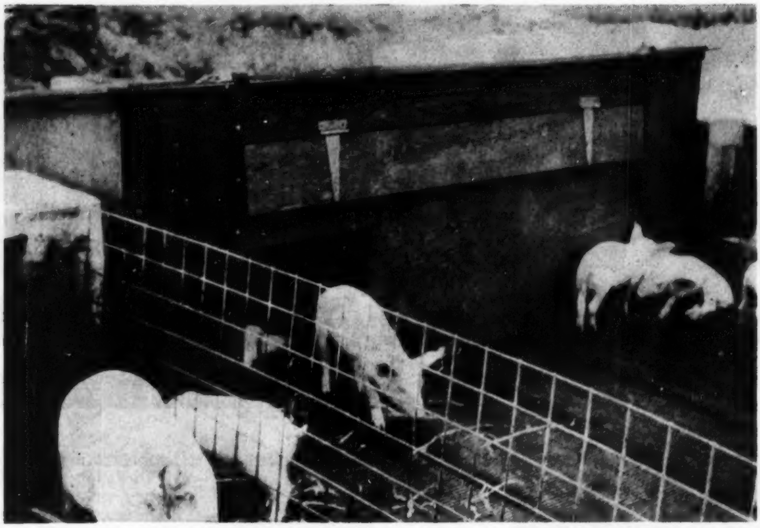
Service

Service Area	Stalls	Cubicles	Loose yards
Dry Housing	Stalls	Cubicles	Loose yards

- Conventional farrow (£31·00 to £39·00†) (£34·50 to £43·00‡) (£50·00 to £62·50§)
  - Move at 17 days
    - *Multiple occupation pens (£19·50 to £26·50)
    - *Solari (£51·50)
  - Move at 3–5 weeks
    - *Verandahs (£8·00 to £9·00‡)
    - *Kennels (£10·50§ to £13·50‡)
- *Farrow to finish (£47·00 to £50·00)

*Up to 70 lb only
†Until 17 days after farrowing
‡Weaned in farrowing crates at 3 weeks
§Weaned in farrowing crates at 5 weeks

Fig. 1 Decision tree—conventional and farrow to finish systems. Costs are gross capital costs of buildings per sow.



'Verandah' housing for weaners showing kennel and wired dung area

Approximate gross costs per crate or per pen, etc. are as follows:

		£
1.	Conventional farrowing crate 3 passages	250
2.	Conventional farrowing crate 1 passage	200
3.	Multiple occupation pens with service passage	315
4.	Multiple occupation pens without service passage	230
5.	Open fronted 15 ft × 5 ft rearing pens (Solari)	150
6.	Squatty Kennels with open welded mesh dunging area (Verandahs)	68
7.	Two row lidded kennels for 240 weaners with central feed passage and open welded mesh dung area	1,150
8.	Monopitch farrow to finish	328

These costs are reduced to costs per sow in Fig. 1, based on two litters per year and 18·5 pigs raised per sow. Assuming progeny is sold at 10 weeks (70 lb) then it can be seen that the costs per sow for farrowing and rearing only can range from £43·50 to £90·50.

Cost effective building

The present demand for increased efficiency will no doubt continue and as far as buildings are concerned there are three main and often contradictory influences:

(a) improving pigmens' working conditions and efficiency;
(b) increasing pig performance;
(c) reducing capital costs.

The effect of the need to improve working conditions and efficiency is becoming more important, particularly with the larger units. On many farms the question as to whether one man can look after 50 or 75 sows and progeny may be irrelevant. But on a 200-sow unit having a building cost of about £30,000 the difference between 3 and 4 men can mean a variation of about

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FARMELECTRIC

10 per cent on the annual cost of fixed capital and labour, i.e., £1,000—£1,500 per annum on profits.

Assuming that pregnant sow housing, farrowing and rearing designs/ are efficient, then one area for potential improvement is often the sow service

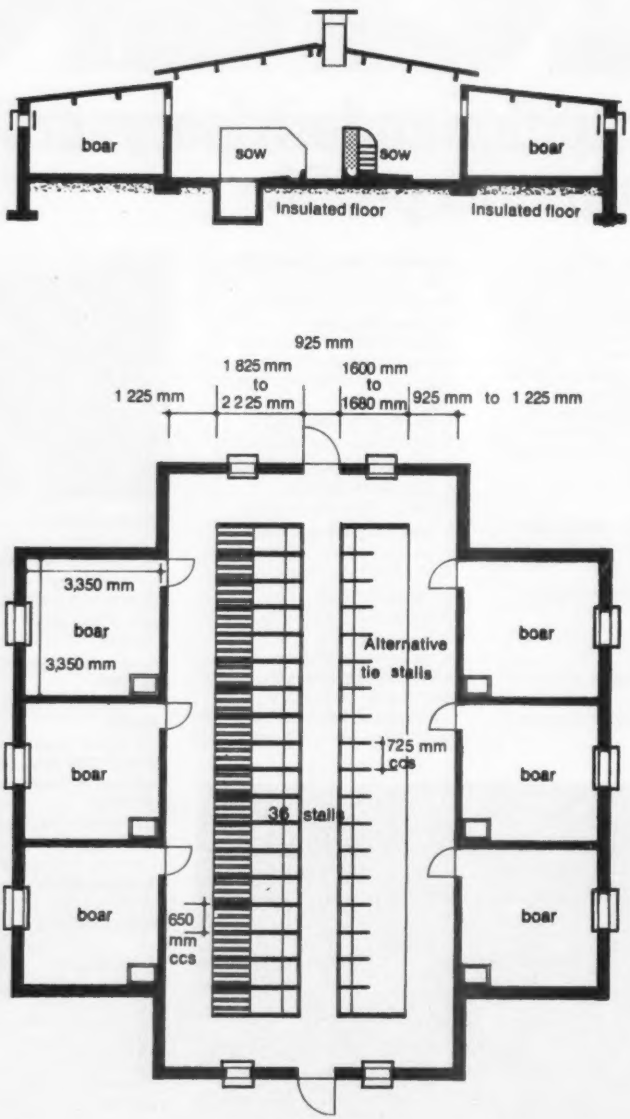


Fig. 2

area. An improvement in conception rate is obviously beneficial to profits and the building design can play an important part. It is now recognized that sows in season should, as far as possible, be within sight, sound and smell of a boar.

In many cases it will be worth while designing special service areas where the sows and some or all of the boars are housed for the period required for two services. The sow housing method in the service area should generally be the same as the remainder of the dry sow housing. Two examples are shown in Figs. 2 and 3.

Where special service areas are not practicable, then some boar pens should be included in *amongst* the sow stalls, cubicles or yards.For maximum

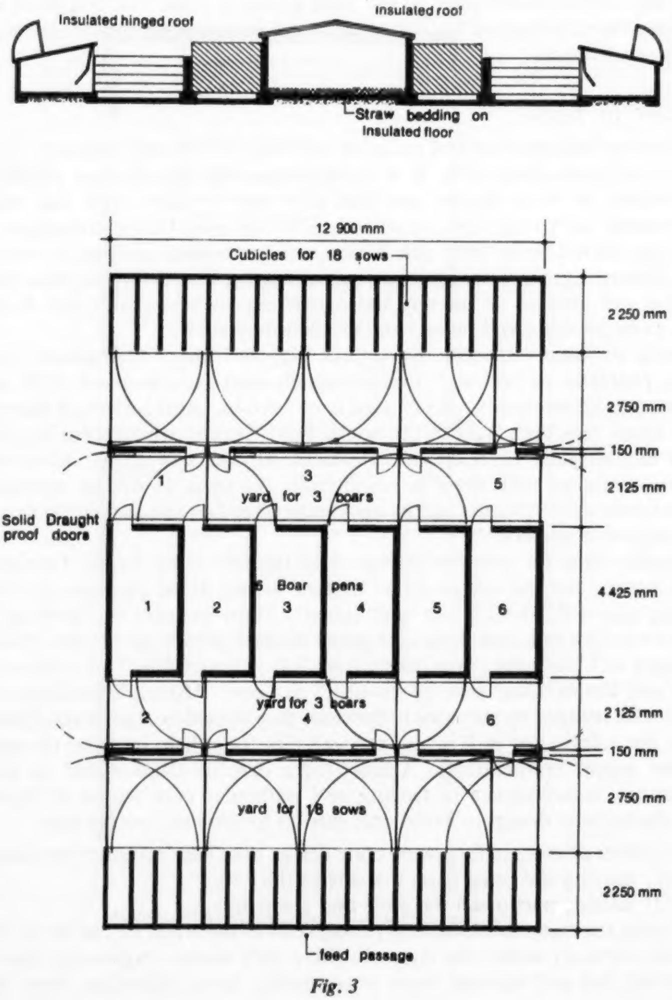


Fig. 3

benefit they should not be sited at the ends of houses. With tied stall houses this is easier to arrange if the houses are planned in four rows. Boars can be held in pens about 11 ft wide (equal to two rows of stalls) in the centre of the house. Fitting boar pens into two row tied stall houses is not so easy and in these situations a modification of the arrangement illustrated in Fig. 2 is probably the simplest solution.

During service periods the movement of pigs should be kept to a minimum and this can lead to layout problems. In large herds (say 200 sows) this can mean that any one sow, for each service, needs to be served by any one of up to eight boars. Where the object is to keep pig movements to a minimum, then layouts similar to Fig. 2 are worth considering. Here all or any one of the six boars can be allowed to run in the exercise and service areas and indicate which sows require serving. Sows can then be turned in with the selected boar and afterwards returned to the same group of sows. The procedure can be repeated with another boar for the second service without moving any of the sows or boars.

Farrow to finish

When we look into ways of reducing capital costs, the cost economy of the farrow to finish system (Fig. 4) is worth noting. Pig performance should be satisfactory in these houses provided that care is taken with the winter temperature for young pigs immediately after weaning. Other advantages are that pigs do not move from pen to pen with consequent savings in cleaning and disinfecting; there are also no litter mixing problems. On the other hand batches can tend to be uneven and equipment such as crates and feeders need to be portable and moved and cleaned frequently.

Past experience with other monopitch piggeries shows that serious ventilation problems will occur if the monopitch span exceeds about 18 ft or if the passage between two rows of pens is covered in. Most houses of this type have up to now been built in the South West Region, where there is a relatively mild climate. There appears no reason why dry sow stall housing could not be combined with these farrowing/finishing pens. It will be interesting to see future developments and to see whether they become popular in regions having harder winters.

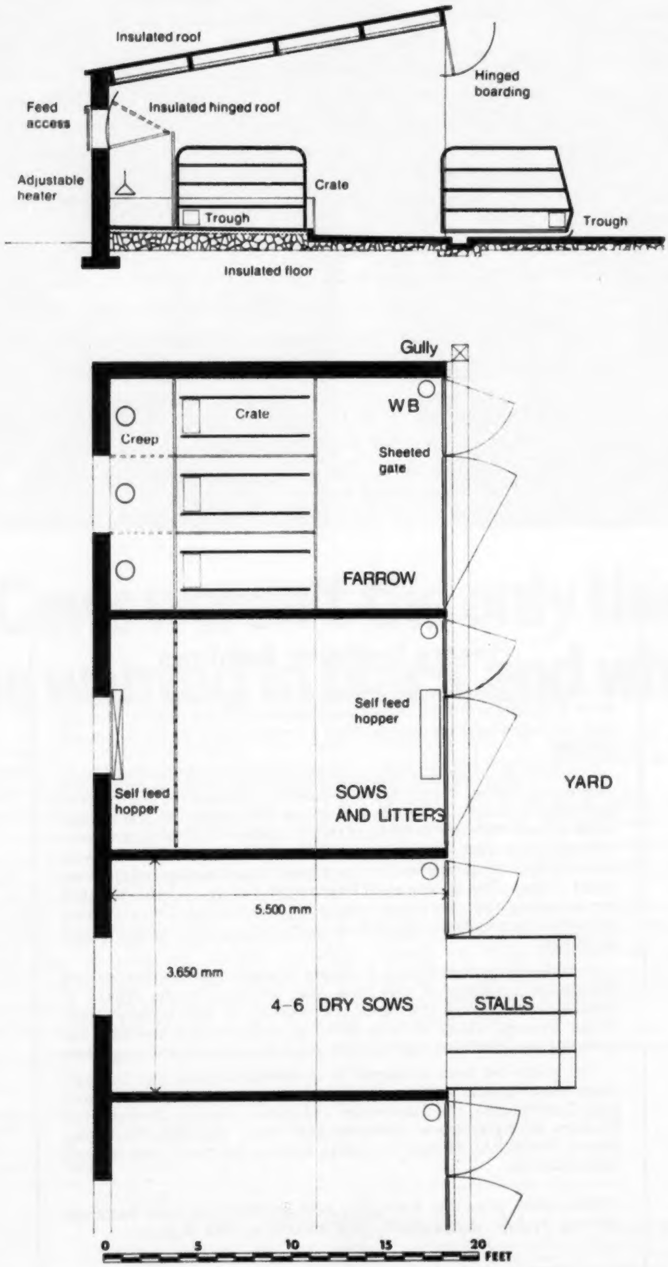
Another area for possible savings is in the farrowing house. Farrowing crate houses for the conventional system having three passages are now costing about £220–£250 per stall (gross). Many farmers are looking for ways to reduce this cost. One acceptable method is to omit the two outside passages and lower the eaves height from 7 ft to about 4 ft. This reduces the span and the building area by about 25 per cent. Although building costs will not be reduced by the same proportion they should be significantly lower. Since the volume per stall is also reduced this could help improve the background winter temperatures. Against these benefits there would be some additional inconvenience in feeding and particular care would be needed with the air inlet design to avoid draughts on to sows and young pigs.

Two other changes in farrowing crate design have been recently introduced:

(1) moving the creep from the side to the end,

(2) slatting part or all the crate and creep area.

Moving the creep to the feeding passage end of the crate, i.e., at the head of the sow certainly makes the pigman's job a little easier—piglets can then be inspected, fed and watered more conveniently. Some difficulties have been



Insulated roof
Hinged boarding
Feed access
Insulated hinged roof
Adjustable heater
Crate
Trough
Trough
Insulated floor
Gully
Crate
WB
Creep
Sheeted gate
FARROW
Self feed hopper
Self feed hopper
SOWS AND LITTERS
YARD
5.500 mm
3.650 mm
4–6 DRY SOWS
STALLS
0
5
10
15
20
FEET

Fig. 4

experienced in attracting newly born pigs from the back end of the sow to the creep lamp—a distance of about 8 ft. Total floor areas are unchanged and building costs have not been significantly affected, but costs are slightly higher due to increased lengths of partitions, etc. Slatting part of the crate—usually about 1 sq. yd at the rear of the sow—is intended to help the rapid draining of urine. Slats are generally of 1 in. × ¼ in. steel flats (or similar) with ¼ in. gaps or 3 in. concrete slats with ⅜ in. gaps. Some solid dung finds its way through the slats. Costs are of course increased by about £10 per crate for very simple small slatted areas and by up to £75 per crate for fully slatted systems.

Whilst partial slatting hardly affects labour convenience or efficiency, whole area slatting does save labour but cannot be justified on these grounds alone. There might be reductions in disease risk and this may or may not improve pig production efficiency.

Conclusion

As usual, the final decision as to the type of house to be selected at any stage depends on many factors. Amongst these only a few have been discussed here and the conflicting needs of the three influencing factors mentioned earlier should be carefully weighed before making a final decision.

Fan Ventilation of Glasshouses

M. Jamieson

THE practice of forced ventilation originated in the mid-west of the United States where the arid summer climate demands a system whereby the cooling air supply to glasshouses must be at a temperature well below ambient conditions. This is achieved by passing the hot, dry air through wet pads so that the evaporation of the moisture results in a significant reduction in air temperature; fans are installed to force the air through the pads.

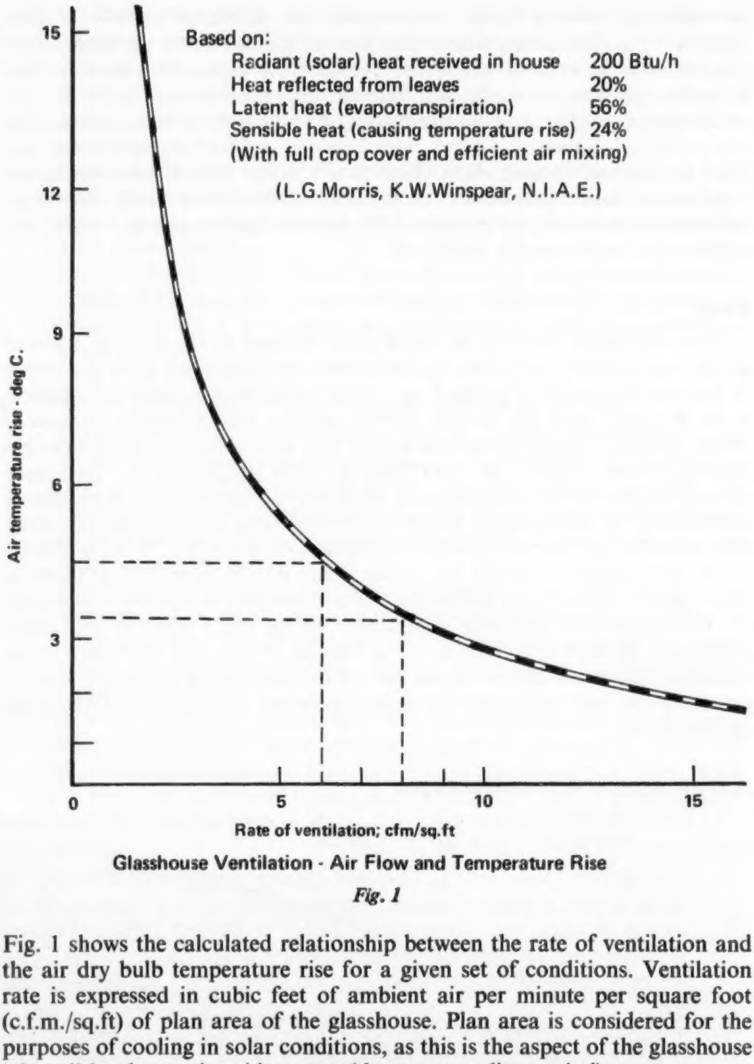
The idea was introduced to the south of England about twenty years ago by flower growers but the wet pads did not give a significant air temperature reduction in our moist maritime climate and were discarded. The fans were retained, however, but with little interest being shown in them until about six years ago when the idea of forced ventilation, especially for flower crops, was suddenly taken up by a number of growers. Statistics show that about 100 acres of glass, mainly on the South Coast and for flower growing, are now equipped with fan ventilation.

Ventilation requirements

The glasshouse ventilation system serves three main requirements—cooling, carbon dioxide replenishment and, in conjunction with heating, humidity control. Cooling in summer makes by far the greatest demands on the ventilation equipment and if the system is designed to deal with this adequately it can be modified to fulfil the subsidiary requirements. Cooling is necessary for most crops to maintain quality. It is well known that air temperatures higher than 27°C even for short periods result in a serious reduction of the fruit quality in tomatoes; similar criteria apply to flower crops. Plant temperature, of course, can be a great deal higher than that of the air. For example, in sunny conditions the temperature of a red carnation flower can be as much as 11°C above that of the surrounding air.

Standards of ventilation

The process of cooling a glasshouse involves the removal of heat generated in two ways. Sensible heat is the name given to that heat which causes the air temperature to rise as it passes through the house and can be measured by means of thermometers and an airflow meter. Latent heat is less easy to measure as it consists of the heat given to evaporation of moisture from the liquid state (as it exists in the plant) to vapour (as it exists in the air). The latent heat of evaporation of water is approximately 1,000 Btu/lb. So, for every pound of liquid water evaporated at the leaf surface, 1,000 Btu of heat is absorbed. This explains how plant tissues remain cool so long as they are supplied with adequate water by way of the roots and by spraying on the leaf surface. The air used for cooling the glasshouse therefore undergoes a change in that it has its dry bulb temperature increased and also its moisture content.



Glasshouse Ventilation - Air Flow and Temperature Rise

Fig. 1

Fig. 1 shows the calculated relationship between the rate of ventilation and the air dry bulb temperature rise for a given set of conditions. Ventilation rate is expressed in cubic feet of ambient air per minute per square foot (c.f.m./sq.ft) of plan area of the glasshouse. Plan area is considered for the purposes of cooling in solar conditions, as this is the aspect of the glasshouse 'viewed' by the sun in midsummer (the worst cooling period).

It is also important to note that airflow requirements are expressed in terms of unit floor area rather than as 'changes per hour'. The latter involves the volume of the house and while there continues to be such a wide variety of glasshouse designs it will be necessary to avoid this expression; for example, the same number of air changes per hour for a widespan house involves nearly twice the volume of air required for a narrow span block of the same plan area. Discrepancies can therefore arise if ventilation data are expressed in this way.

The information in Fig. 1 is calculated for the worst normal conditions likely to be encountered in Britain. It shows that as the rate of ventilation

increases, the ventilating air temperature rise decreases, rapidly at first, eventually reaching a stage where there is very little decrease in air temperature rise (increase in cooling effect) for considerable increase in airflow rate. Roughly speaking, a ventilation rate greater than about 10 c.f.m./sq.ft yields little return for the extra capital (larger ventilators or fans) and running costs involved. Similarly, airflow rates below about 5 c.f.m./sq.ft result in a large decrease of cooling effect. Thus it can safely be said that ventilation rates within the range of 6-8 c.f.m./sq.ft are adequate for most conditions, and this is borne out in practice with fan ventilation systems, where the airflow rate can be readily measured.

Fans

There are many types of fan which could be used as the basis of a forced glasshouse ventilation system, but economic considerations limit the choice in practice to simple propeller fans widely available for industrial applications. Basically these are directly driven impellers with a varying number of blades (usually four) rotating in a simple ring or diaphragm. The blades are normally made from sheet steel bent to shape to propel the air axially through the fan. On the less expensive types of propeller fan used in glasshouse ventilation, the aerodynamic properties of the blades are minimal. However, they serve the purpose of cheap movers of air satisfactorily. The main characteristic of a simple propeller fan is that it will handle large quantities of air only against relatively low resistances. As the resistance to airflow is increased, the throughput falls off quickly. Similarly, as the static pressure (or airflow resistance) is increased, the power absorbed by the fan increases. It is, therefore, important that propeller fans be installed in low resistance systems to obtain the best airflow for the capital involved and also to minimize the running costs.

Advantages and disadvantages

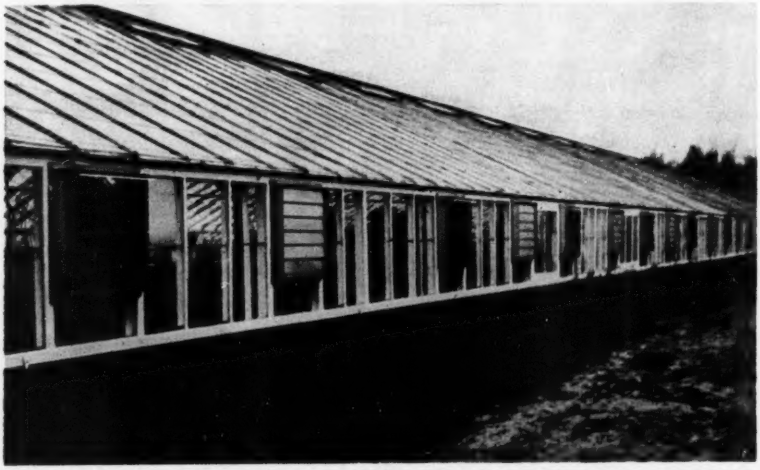
To be worth while, fan ventilation must show some advantages over ridge ventilation. The most important of these are:

1. Positive air movement is obtained during ventilation. This should result in better photosynthesis, and therefore better growth, as there should be improved gaseous interchange at the leaf surface. Positive air movement should also promote more efficient cooling by carrying off heat more efficiently from the leaves. Moisture should also be removed efficiently so that a better microclimate (lower relative humidity) resulting in less spread of fungal disease should be obtained. It will be appreciated that the benefits of 'positive air movement' are rather nebulous and difficult to quantify. They are also not obtained when there is no demand for ventilation.
2. In new glasshouses, particularly multispan blocks, the omission of the overhead ventilator gear should result in better light transmission into the house. Experience shows that fan ventilation can be installed in such houses for no (or little) increase in cost compared with roof ventilation.
3. In very large blocks of multispan houses the efficiency of the roof ventilation system is often low. Fan ventilation should be an improvement in these circumstances.

4. Workers often prefer to work in fan ventilated houses, which are usually cooler due to the more positive air movement.
5. Probably the greatest advantage of fan ventilation is its use in old, structurally sound houses. These can be given a new lease of life as limited ventilation is often the greatest drawback to houses more than about ten years old.
6. Fans are the only means of effectively ventilating the larger forms of walk-in polythene tunnels. Any form of break in the continuity of the plastic film is undesirable and the installation of fans in the end walls is a simple procedure.
7. Fan ventilated houses should be more airtight than those naturally ventilated because the problem of making ventilators fit snugly in the closed position is avoided. This should reduce heat consumption in windy weather.

Against these advantages certain drawbacks must be considered:

1. The running cost of fan ventilation may be considerable. For example, in 1969 one grower measured the annual consumption of his fan system at about 35,000 kWh/acre; at 1p per unit this amounts to £350. He was controlling at a temperature of 21°C. Lower temperature requirements, e.g., for some flower crops, would result in more fan-operating hours and higher costs.
2. There are problems of control and distribution of air at low rates of ventilation. The on/off nature of most propeller fan systems makes the equivalent of a 'crack on the vents' difficult to provide. In some houses enough air can be drawn through the glass overlaps for effective winter ventilation.
3. In a fan ventilation system there is a persistent temperature gradient from inlet to outlet due to the ventilating air picking up heat as it passes across the house. This may not be important for some crops but for those short-term flower crops which must be at a given stage at



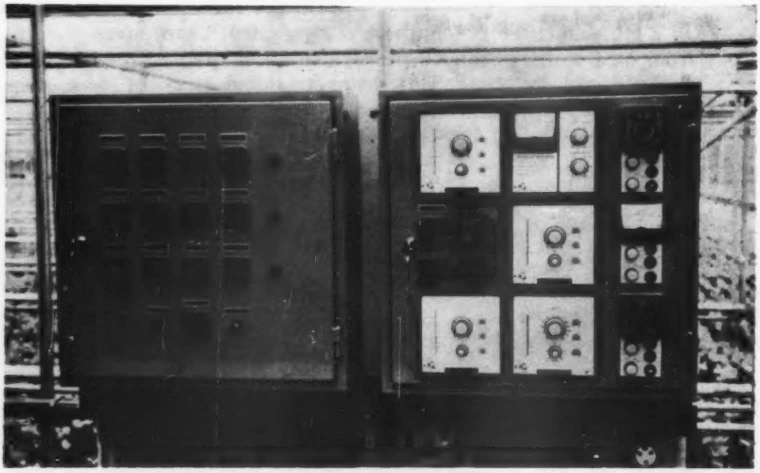
The installation of 24 in. propeller fans in this timber house has given it a new lease of life as one of its major drawbacks was insufficient natural ventilation

a predetermined time, uniformity is important.

4. The drastic effects of a power cut should not be overlooked. Power failures in summer are infrequent but do occur occasionally. A standby generator is thus a worthwhile consideration where any considerable area of a valuable crop depends wholly on fans for ventilation.
5. Worker dissatisfaction due to noise may result from poor choice of fans. Unbalanced rotors may rattle the glass and glazing bars of the house. In addition, the whine caused by high blade velocity where small fans are being used at high speeds can be most unsettling.

System designs

Fan ventilation systems should be chosen to give a design airflow of 6–8 c.f.m./sq.ft of glasshouse plan area against a pressure of 0·1 in. W.G. Fans are normally used for extracting the air rather than for pressurizing the house; zones of high velocity air from fans can damage nearby plants. The recommended layout in multispan houses is for the ventilating air to be moved across the ridges and gutters to promote better mixing and therefore more efficient cooling. Where this is not possible, for example, in the centre spans of a block which is fitted with partitions and the fans and inlets are fitted in the gable ends, it is advisable to fit transparent plastic film curtains at 50–70 ft intervals in the ridge spaces to direct the air downwards into the crop. To minimize the resistance to airflow, the maximum calculated air speed in the glasshouse should not exceed 300 ft/min. The places where this speed is likely to occur are at the inlets and under the gutters. Inlets should therefore provide approximately 1 sq. ft of opening area for each 50 sq. ft of plan area of the house.



A comprehensive panel in a 0·8 acre glasshouse for thirteen 48 in. fans integrated with the heating system to give accurate control of aerial conditions

The fans themselves should not be spaced too far apart. The most common system of control is where the fans are switched on or off in groups. When there is a low demand for ventilation, therefore, the operating fans will be further apart than when all fans are working. If this distance is too great, stagnation in the area between fans is likely to occur. It is therefore recom-

mended that the maximum distance between fans operated on group or step control systems be no more than 20 ft from centre to centre. Where fans are controlled on a continuously variable speed basis the recommended spacing is 30 ft from centre to centre. These recommendations are based largely on current experience in the absence of precise experimental conclusions.

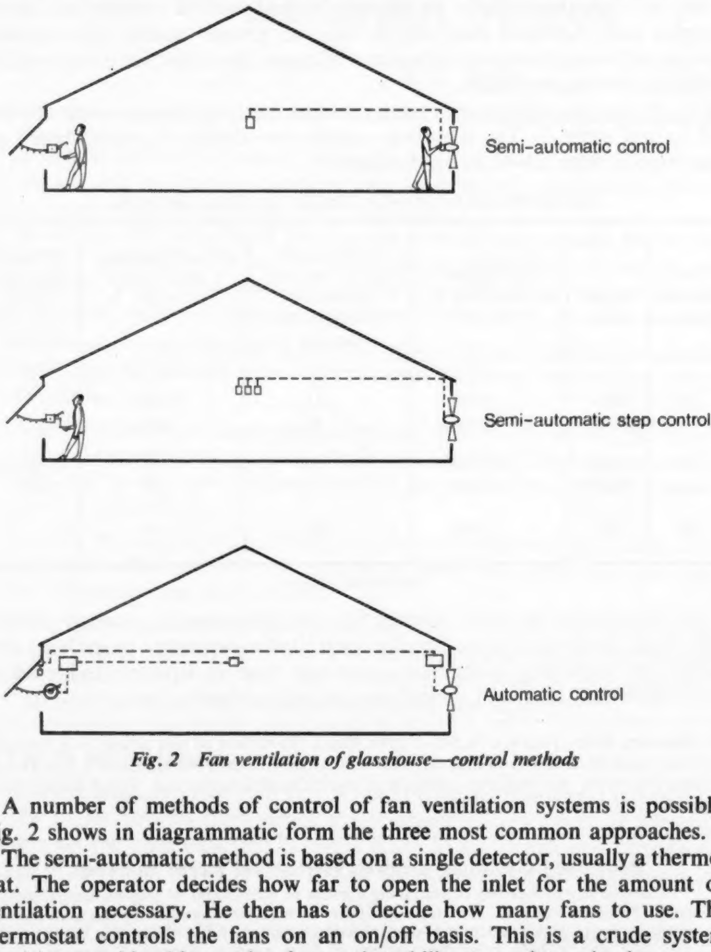


Fig. 2 Fan ventilation of glasshouse—control methods

A number of methods of control of fan ventilation systems is possible. Fig. 2 shows in diagrammatic form the three most common approaches.

The semi-automatic method is based on a single detector, usually a thermostat. The operator decides how far to open the inlet for the amount of ventilation necessary. He then has to decide how many fans to use. The thermostat controls the fans on an on/off basis. This is a crude system requiring considerable weather forecasting ability to predetermine how many fans will be required on a given day and the mode of control gives rise to hunting (frequent on/off operation).

A more sophisticated approach is semi-automatic step control. Here, the operator still has to open or close the inlet manually but all fans are controlled automatically in groups, each group having a separate thermostat. The thermostats are set at about 1–2°C intervals so that with three groups of fans an operating band of 3–5°C between minimum and maximum ventilation rates can be obtained. This method is the simplest that can be recommended. It works well in practice and is relatively inexpensive to install.

A third, fully automatic system, uses a modulating controller which operates the inlet according to the amount of ventilation required. The inlet position is used to control the fan output. This can be by switching on groups of fans, by bringing on all fans in steps of speed, or by changing the speed of infinitely variable speed fans controlled by thyristors or by auto-transformer.

Any of these methods is satisfactory. Speed control systems are more complex and expensive than simple step (or group) control and suitable equipment for continuous speed control of larger fans is not yet commercially available at economic prices.

Glasshouse fan ventilation systems can be built up from a range of fans and control methods. The table below gives some details of systems based on fans ranging from 24–48 in. in diameter.

Installation data for propeller fans for glasshouse ventilation

Fan diameter inches	Speed r.p.m.	Air output c.f.m. at 0·1 in. W.G.	Approximate cost of each fan including shutters and guards	No. of fans per ½ acre to give 7 c.f.m./sq. ft	Installed cost per ½ acre with step control
			£		£
24	920	5,850	45	26	
	1,400*	9,260	45	16	
36	560	11,800	75	13	1,100 to
	700*	15,300	95	10	1,400
48	360	17,000	125	9	

*excessively noisy

Fan ventilation has been accepted by a large number of growers, particularly those growing flowers. Strictly controlled experiments to evaluate this method of ventilating glasshouses have not been undertaken and growers must make their choice of system on a largely subjective basis.

M. Jamieson, B.Sc., (Agric.), M.Sc., (Agric. Eng.), the author of this article, is a specialist on glasshouse mechanization and environment control in crop buildings at the A.D.A.S. Liaison Unit with the National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedford.

Proposed Guide to English Historical Farm Records

The University of Reading is preparing a guide to collections of English historical (pre-1940) farm records. The guide will describe material collected by the University's Institute of Agricultural History, held at present by the University Library, and will also include brief descriptions of farm records deposited elsewhere. Information about other collections is now being gathered from the National Register of Archives and from County Record Offices.

Many museums, libraries, local historical societies and private individuals may, however, own unrecorded collections. The compilers of the guide would be glad to hear from any institutions, organizations or persons who might hold farmers' account books, diaries, memoranda, leases, agreements, valuations, sale catalogues and business correspondence.

Owners of such records are invited to write in the first instance to Mr. J. A. Edwards, University Archivist, The Library, University of Reading, Whiteknights, Reading, Berks., informing him that a collection exists. Mr. Edwards will then be glad to arrange for a brief description of the records to be entered on a standard form of inclusion in the guide.

Reducing Dust in Grain Stores

W. J. Walne, *A.D.A.S., Maidstone*

THE creation of dust is inevitable in any building where grain is moved or processed and it is not practical to think in terms of a completely dust-free atmosphere without incurring very high costs.

At its best, the presence of dust is little more than a nuisance but in many cases the amount pervading the atmosphere, particularly at harvest time, is excessive to the point where it can effect the efficient working of the plant and the men within it. The main problems arising from excessive dust are:

Inefficient drying. Ventilated floors in grain bins and lateral ducts in floor stores can be blocked by moisture laden dust being re-circulated through the drying system.

Pests. Undisturbed accumulation of dust on roof trusses and inaccessible parts of the store provide ideal conditions for the harbouring and multiplication of pests, insects, mites, bacteria, etc., which can rapidly spread to grain stored in bulk.

Health. No one enjoys working in a dusty atmosphere. Inhalation of fine particles is difficult to avoid, even when masks are worn, and over a long period can be harmful to health.

Fire risk. A fine suspension of dust can, under certain circumstances, form a potentially explosive mixture. The current regulations covering electrical installations point out the need to reduce fire hazards by installing the correct type of electrical apparatus in dusty atmospheres.

Plan to avoid trouble

It is not suggested that dust can or need be totally eliminated but there are a few major sources from which the problem mainly arises. If preventive action on the lines indicated below is taken at the design and construction stage of the store, it can greatly reduce the problem when it is brought into operation.

Position of fan unit. Many ventilated grain stores are constructed with the main fan units sited in the reception area and too close to the intake pit. This can result in clouds of dust being drawn straight into the fan unit and the perforated floors in the bins becoming completely blocked. Then the floors may have to be removed for proper cleaning of the plenum chambers, ventilating ducts and floor sections at much more frequent intervals than might otherwise be necessary. When dried grain is out-loaded from stores, large quantities of dust are often created; if the delivery end of the outlet system is next to the doorways into the reception area, clouds of very dry dust can be drawn back into the building and, where the main drying fan is used to operate self-emptying floors, recirculated into the system.

Wherever possible, therefore, the fan unit should be located in a separate fanhouse away from the reception and bulk loading area. There may, however, occasionally be no alternative to installing the fan unit in the reception area. In such cases trouble can be avoided if the unit is set as far away from the reception pit as possible, with the air inlet on an outside wall or as near to it as possible so that it can draw the proper amount of free air from the outside atmosphere. In some cases it may be advisable to install ducting from the fan inlet to the outer wall.

Natural ventilation. Insufficient ventilation to allow moist and dust-laden air to escape after passing through the grain is a common fault, particularly where drying and storage equipment has been installed in existing buildings. It is often overlooked that if the drying process is to operate efficiently the large volume of air forced into a building and becoming moisture-laden must be allowed to escape and be replaced by clean fresh air. Adequate ventilation in the top of the storage building, usually in the gable ends, should always be provided to allow at least 1 sq. ft of free ventilation area per 1,000 cu.ft/min. of fan output. Louvred ventilators can often reduce air flow, particularly if the louvres are too close together and too steeply pitched. A simple opening with removable shutters or centre pivoted vents, to produce an unrestricted aperture, is preferable; such openings should be wired against birds.

Siting. The choice of site for the building is, of course, a vital decision for several reasons. If, having regard to other important siting factors, it can be orientated so that the prevailing wind carries dust away from, rather than into, the storage area it can make a big difference. Similarly, if the building can be set so that the prevailing wind blows along its length, rather than at its side, it can help to clear out dust and moisture, subject to the proper means of ventilation being built in.

Exhaust material. Where equipment for cleaning grain and separating out unwanted debris is installed, the exhaust should not be dispersed to the atmosphere close to the point where the fan unit is drawing in large volumes of air. When a continuous drier is installed, it should be separately housed or at least effectively screened and sealed off from the main storage area and provided with its own ventilation and dust extraction equipment.

Sometimes the debris exuded from the exhaust from continuous driers is left to accumulate in a heap outside the building and can easily be blown back into the storage area—to say nothing of the weed seeds dispersed on the wind. It is well worth while building proper chambers to trap exhausts from cleaners and driers.

Where dust can be trapped and directed away at its point of origin at a modest cost, it is well worth doing. Dust extractors built into the head of primary elevators can be particularly useful.

Handling machinery. Economics are usually the governing factor when selecting the storage system and machinery which goes with it. For medium to large quantities of grain, the simple on-floor store is generally the cheapest system, but usually a fast loading rate is needed to fully exploit its advantages, particularly where very large quantities of grain are involved. Unfortunately, the type of equipment likely to achieve this may bring with it a particularly difficult dust problem. In such cases it may be worth considering whether more sophisticated handling equipment should be used, such as a pneumatic system rather than a mechanical thrower, which could reduce the incidence

of dust. With this system it would be more important than ever to build in very adequate ventilation to clear the atmosphere within the building as quickly as possible.

Conclusion

The troubles caused by dust become apparent only after a new installation has started operating and, at that stage, it may be too late or, at best, very expensive to put right. So it is important that these few basic considerations are given proper thought at the planning stage. They need not add significantly to the cost but they can make a big difference in the way the system operates and in the conditions under which farm staff will have to work.

Ministry Publications

Since the list published in the November 1971 issue of *Agriculture* (p. 503) the following publications have been issued.

MAJOR PUBLICATIONS

BULLETIN

No. 156. Cane Fruits (Revised) 40p. (by post 42½p) (SBN 11 241456 7)

TECHNICAL BULLETIN

No. 20. Residual Value of Applied Nutrients (New) £3·50 (by post £3·70) (SBN 11 240920 2)

FREE ISSUE

ADVISORY LEAFLETS

No. 11. Winter Moths (Revised)
No. 96, Apple and Pear Suckers (Revised)
No. 224. Red Spider Mites on Glasshouse Crops (Revised)
No. 226. Red Spider Mite on Crops in the Open (Revised)
No. 279. Skin Spot and Silver Scurf of Potatoes (Revised)
No. 328. Bees for Fruit Pollination (Revised)
No. 429. Fertility and Hatchability in Fowls (Revised)
No. 435. Making the Most of Farmyard Manure (Revised)
No. 462. Pea Cyst Eelworm (Revised)
No. 518. Lime in Horticulture (Revised)
No. 520. Liquid Feeding of Tomatoes (Revised)
No. 577. Lettuce Downy Mildew (New)
No. 578. Swine Dysentery (New)

SHORT TERM LEAFLETS

No. 38. Production of Early and Maincrop Tomatoes in Heated Glasshouses (Revised)
No. 46. Grassland Practice No. 1. Seeds Mixtures (Revised)
No. 123. The Nutrition of Glasshouse Chrysanthemums (New)
No. 133. Cyclamen Mites on Glasshouse Plants (New)

FIELD DRAINAGE LEAFLET

No. 11. Mole Drainage (New)

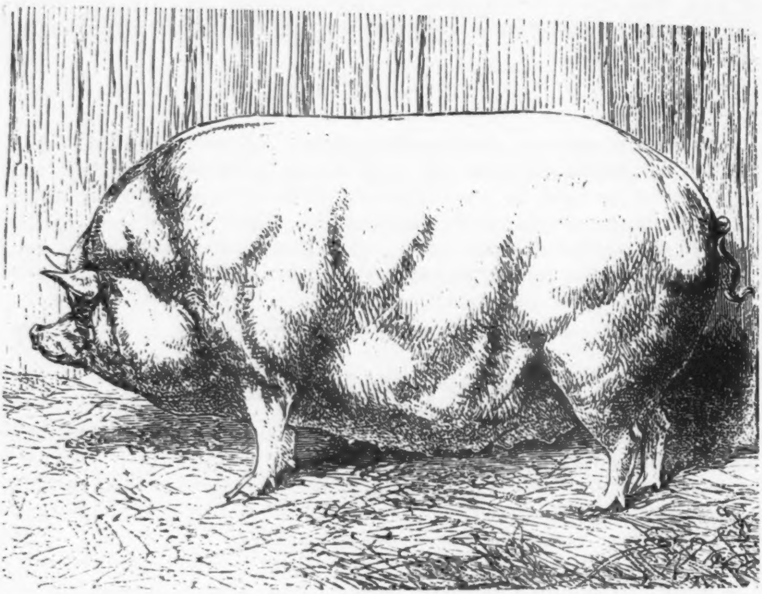
HORTICULTURAL ENTERPRISES

No. 3. Runner Beans (New)

UN-NUMBERED LEAFLET

Safe and Efficient Fumigation Practice
Code of Practice For the Fumigation of Soil With Chloropicrin (New)

Priced publications are obtainable from Government Bookshops (Addresses on p. 558) or through any bookseller. Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.



'Miss Emily' was a famous Yorkshire Medium or Middle Breed. Her mature girth taken behind the shoulder was 7ft 1in.

Just reminiscing . . .

Bygone Baconers

John L. Jones

NOTHING is more fascinating in the perusal of old farming books than the preoccupation of our agricultural forebears with the sheer size and weight of livestock. The prescription seems to have been elementary. You fed the pigs and cattle until they could hardly stand. Indeed, 'he must not be killed until he cannot walk' was the eighteenth century advice for the pig feeder. A farming parson of the mid-nineteenth century put it thus 'A good little pig is very well, but a good big pig is better.' And Cobbett wrote, 'if he can walk two hundred yards, he is not fat'.

'A good fat pig to last him all the year' was the philosophy behind the feeding of the eighteenth century cottage pig. The weights achieved make this quite credible. A Cheshire farmer, writing in 1860 about the old Cheshire pig, tells of how his 'son met with a fine specimen last year in a sow which he brought to breed with our boar of the Berkshire small breed, but changed his mind and fed her. She weighed when killed 42 score 12 lb (825 lb dead-weight) . . . the hams weighed 77 lb'.

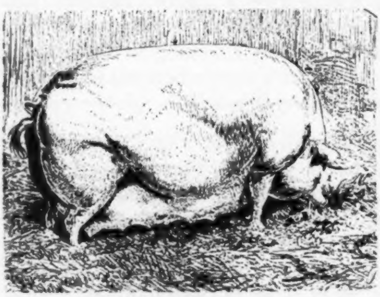
The 'Yorkshire'

The Large White today is still referred to as the 'Yorkshire' in some European countries, and what a tradition this county once had for Large White pigs. Two prize-winning fat (half-sister) sows weighed at Rotherham 1856, and then aged just over 3 years, scaled over 11½ cwt apiece. From the ham to the end of her nose the larger was 7 ft 2 in., and her girth behind the shoulders close to the forelegs was 7 ft 8 in.

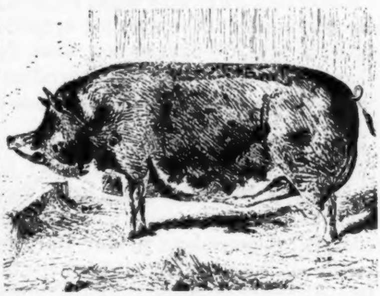
The Yorkshires of those days were fed for both pork and bacon, but pork was derived principally from the killing of the pigs at a few weeks old, at the sucking pig stage. 'Their skin is fair and white', remarks an old writer, 'which looks more agreeable than dark skins when brought to the table.' He adds, that the large breed of Yorkshires could be fed to 60 stone of 14 lb, or 840 lb, and quotes also a well known producer from the *small* (!) York breed who 'gets them profitably up to 600 lb where thick bacon is required'.

But for size, surely the assembly of twelve sows at Northallerton in 1859 must surely hold the accolade. Together they weighed just under 6 tons!

These were pigs of a maturity that we don't see today. But even in weight for age it seems the best Yorkshire pigs of over a hundred years ago could compete with the best today. A good Yorkshire pig fattened *ad lib.* could attain 250 lb in seven months, and a century ago fetched up to £6·50. There are some interesting figures also for the old Oxfordshire breed which survives as the Sandy Oxford on a few farms today. Porkers at thirteen to sixteen weeks were expected to weigh 90 lb: bacon pigs from the improved Oxfords at nine to ten months 'are easily brought to 400 lb'.



Sow of Yorkshire Large breed (mid-19th century)



Improved Berkshire boar (mid-19th century)

Cross breeding

A successful cross in the mid-eighteenth century was the so-called White Leicester which was a cross of the native country breed into the middle or small Yorkshire. A producer of fat pigs of this cross has recorded his 'specification' for us as follows. Fat pigs from 5 to 6 months old would average 140 to 180 lb, at 8 months from 200 to 240 lb, at 10 months 240 to 300 lb, and at 12 to 18 months the pigs would weigh from 300 to 360 lb. This same producer, who competed in the Smithfield fat pig class at Smithfield in 1854, won with a pen of pigs which at 18 weeks old weighed 180 lb deadweight.

In the evolution of many high performance breeds and strains, the breeders of the late eighteenth century and the nineteenth century were bold experi-

menters and, like some modern pig breeders, imported exotic breeds. A pair of black pigs, a boar and a sow, were imported from near Naples in 1839, and this Neapolitan blood is reputed to have been an important factor in the breeding of the improved Essex. The best of the prick-eared White breeds, such as the Yorkshire, undoubtedly carried a cross of the imported Chinese breed, as did also the important Berkshire and the Essex. The principal role of the Neapolitan pig on the Berkshire seems to have been to reduce the size of the big strain in order to provide a middle size bacon pig. Similarly, it was used on the black Essex breed to produce a porker of small size and improved leanness for pork.

Some of the well-known feeders considered that the cross of the black Berkshire on the red-skinned, immensely hardy, Tamworth, the handsome native pig of Staffordshire, was the most economical cross for fattening. Already the notion of exploiting heterosis was taking firm root in the fattening of pigs, sheep and cattle.

Sow productivity

Nor, it would seem, were litter numbers reared in the best herds notably different from today.

The 11½ cwt sow referred to earlier was herself an excellent breeder. On two occasions she is recorded as having farrowed two litters within twenty weeks of each other, and 'seldom reared less than thirteen at a time'. Another prize winning sow is recorded as having weaned thirty-three pigs before she was twenty-two months old.

Nineteenth century pig keepers also had a keen appreciation of one of the really vital statistics of profitable sow keeping. This is the need to produce a minimum of two litters inside the year, from every sow. Indeed, it seems that the best nineteenth century pig keepers had no difficulty in producing over two litters a year from their best sows, for an authority writing in 1856 states that 'a good breeding sow will produce two litters a year: where she is allowed to have more, the pigs are not so fine or so many in number . . . '.

Longevity

Many of them had long lives, too. 'A sow is fit for pigging up to her seventh year, and many will continue to be so even longer', was a well-accepted management axiom. But this time-scale is dwarfed by the performance of the famous half-bred bantam sow described by Gilbert White in his *History of Selbourne*. This sow was 'as thick as she was long and whose belly swept on the ground until she was advanced to her seventeenth year, at which period she showed some tokens of age by the decay of her teeth and the decline of her fertility. For about ten years this prolific mother produced two litters in the year of about ten at a time, and once above twenty at a litter . . . At the age of about fifteen her litters began to be reduced to four or five . . . At a moderate computation she was allowed to have been the fruitful parent of three hundred pigs . . . She was killed in the spring of 1775'.

John L. Jones, B.A., was the author of the article **The Sporting Pig** published in the November issue of **Agriculture**.

The Berkshire chalklands

Farming Cameo: Series 5

3. Berkshire Chalkland

James Wilkie

THE Royal County of Berkshire is justly famous for its well farmed, free-draining yet drought-resistant chalkland. On this rolling downland, covering over a quarter of the county, the 'golden hoof' has given way to the combine drill.

The gallops

Only on the sacred gallops can we now see the grass as it was one thousand years ago when Alfred ruled Wessex and met the Danes from time to time near Wantage. The gallops, great tracts of fine turf 100 yards wide and 3 or 4 miles long, march straight across the undulating countryside with a fine careless disregard for farm boundaries past or present. Their furlong markers, like orderly rows of dinner plates, mystify many an airborne traveller. Earthbound travellers are discouraged from trespassing on this sward which is dedicated to the advancement of bloodstock breeding. Where even a small pothole causing a racehorse to stumble could be an expensive affair. It is recognized in the area, too, that casual visitors are more likely to be interested in horse flesh than herbage, and more concerned with form than farming.

Then there are the roads along the tops like the Ridgeway, living proof that travellers of previous generations recognized the importance of a dry foundation for a road. The majestic view over the valley below and the glor-

ious sound of lark-song overhead must have cheered many a footsore traveller in tougher times. Today they still bring great joy to modern Ridgeway walkers keeping a rendezvous with car or bus at some not too distant point.

For the botanist there are the rare, carefully guarded 'wind flowers' and the wild fuchsias in the hedges which have escaped the vandals.

Archaeological features

At Kingston Lisle is to be found the strange blowing stone, used in former times to summon troops in times of invasion. This peculiar ancient public address equipment still presents a challenge to those sound in wind.

The great Sarsen stones on the hillside look like petrified sheep. Indeed on the downs to the north of the Vale of Pewsey in Wiltshire such stones are known as grey wethers!

There are also to be seen the barrows of the illustrious dead, one of the best examples being at Waylen Smithy above Uffington.

Chalkland farmers

For the farmer, chalkland was at one time very cheap to buy or rent but the ploughing-up campaign of the Second World War changed all that. Farmland which fetched £5–10 an acre between the wars now costs £250–300 an acre.

The silage maker finds a pit on the chalkland slope a godsend because it is completely free of all effluent problems. Some pits in fact are ready made where the chalk has been taken for road making.

On the black, puffy downland above the chalk, copper deficiency still occurs but there is no longer the deficiency of potash which was once so noticeable. Nowadays adequate supplies of phosphate appear to be what matters.

Pioneering prowess

On this chalkland pioneers, too, have been at work. The Hosier milking bail, the Bayliss system of stockless farming and the Roadnight system of out-door pig keeping are but three revolutionary practices which came from the chalklands.

Then there was Jethro Tull of Prosperous, Hungerford, founder of horse-hoe husbandry. It is said that he was moved to build his first corn drill because of his interest in pipe organs.

Not only was Jethro Tull the founder of modern crop husbandry but he was also the source of inspiration of the Jethro Tull Club, whose members are drawn from agricultural teachers, research workers and advisers operating within the Royal County of Berkshire. The club is unique in that it has no entry fee and no subscriptions, yet each year has a full programme.

Just as the flint knappers on the high tops of the chalklands were the men of ingenuity in prehistoric times, so this tradition of ingenuity lives on in the Berkshire Downlands of today.

in brief

- **Pigs as a cereal break**
- **Spring wheat instead of barley**
- **In search of a name**

Pigs as a cereal break

THE attractiveness of intensive cereal growing which characterized the 'fifties and 'sixties and evolved the legendary barley barons has been dimmed by the mounting problems imposed by pests, diseases and weed infestation. Predictable financial pressures have also revealed the weak points in this new-style husbandry and in consequence the search now, in many parts of the country, is for a recuperative but profitable break crop. It was in the light of this need that the Ministry's Enterprise Studies Committee directed attention to the possibilities of outdoor pigs as a likely worthwhile cereals break, particularly having in mind that pigs have been so used with notable success on the light, chalk downlands of southern England. The survey*, carried out by Wye College and Reading University and now published under the authorship of Michael A. B. Boddington, shows how viable an outdoor pig keeping break in cereal growing can be expected to be. A more detailed Summary of the Report will appear in the January 1972 issue of *Agriculture*.

The survey was based on a postal questionnaire among farmers in the more climatically favoured and light land area of southern England stretching from Dorset to Kent and Essex; this is also the area where the need to find a suitable cereal break crop is especially urgent. Here (in 1968) crops and grass comprised about 4·8 million acres, of which 41 per cent was under a cereal—a substantially higher proportion than the average for England and Wales. Whilst the selected counties possess only 20 per cent of the crops and grass, they grow some 24 per cent of the total cereal acreage. The average size of the forty-six farms for which details became available was 449 acres, and of this nearly two-thirds was arable: if temporary grass is included in the arable land, the figures become 405 acres and 88 per cent. Thus the farms were large by present standards. Fifty-five per cent of the total acreage was under a cereal, barley accounting for one-third and wheat a further fifth.

Viewed from the profitability angle, the report states quite firmly that pigs kept outdoors are in no way less profitable than those kept intensively, and indeed constitute a sound financial feature on many large arable farms. It has to be said, however, that the outdoor system shows up badly on productivity when compared with indoor units; the number of litters and of piglets reared per sow each year is rather low. But, says the report, 'these inadequacies are more than compensated by the very low costs incurred in terms of labour, housing and other charges, so that in the final analysis the surplus achieved, however measured, compares more than favourably with the performance of the indoor herd'. This good surplus is the result of exceptional performance in the summer months; the figures for the winter period are disappointing.

Since any cereal break these days has at least to pay its way besides contributing to the longer-term consideration of responsible husbandry, the expected financial return from outdoor pigs given in the report is encouraging—a surplus per sow of between £18 and £20. A further point of interest is that there was some evidence that subsequent yields of cereal crops were improved and that less fertilizer may be needed; in some instances, it is said, the fertility of the soil may be so enriched as to cause lodging.

***Outdoor Pig Production.** (Econ. Report No. 4). Obtainable from the School of Rural Economics and Related Studies, Wye College (Univ. of London), Ashford, Kent, 75p.

Spring wheat instead of barley

THE poor showing of spring barleys this year (as also in 1970) under attack by brown rust and mildew suggests that spring wheat may be a more profitable crop. Traditionally, for most farmers spring wheat was something of a fall-back under impossible autumn conditions, but modern high-yielding varieties have much to commend them in their own right. Mr. Bernard Smith, of the National Institute of Agricultural Botany, made this point when speaking at Terrington earlier this year and referred particularly to the latest recommended variety, Kleiber, which under trial this year yielded 40·3 cwt/acre, so displacing Kolibri (38·7 cwt/acre) from leadership. Cardinal and Maris Dove also have their devotees, but obviously as much depends upon farm situation and circumstances as it does upon personal choice. Still under trial are Sappo and Tilley, both of which have shown good quality grain and high yield. Mr. Smith emphasizes, however, that it is important to drill early for good yields—late February, early March.

The following figures, supplied by Mr. Smith, are of interest as showing the incidence of brown rust attack on spring barley this year related to variety:

Variety	Julia	Zephyr	Proctor	Midas	Sultan
Yield cwt/acre	40·5	35·4	35·0	33·2	32·2
Brown rust % (July 9th)	25	75	75	90	90

In search of a name

WITH every extension of man's command over nature, scientists have been adding new words to the world's languages. Not infrequently they are of an esoteric nature and involved in a terminology which is not readily comprehensible across the frontiers of the various disciplines. Some are of obscure parentage, but most are born out of the classic tongues of Latin and Greek, with hybridization strongly in evidence. Word-making so based has the advantage of more ready understanding and acceptability throughout the greater part of the world, and for this reason is to be encouraged.

Writing in the current issue of *Pans* (Vol. 17, No. 3) Professor P. N. Camargo, of the University of Sao Paulo, Brazil, adds his authority to the need to find an international name for weed science—a matter which has so far defied solution since the Committee of the Weed Society of America threw down the gauntlet in 1962. Dr. E. C. S. Little, describing the quest in 1967 as that of a Jason in search of another Golden Fleece, suggested the word 'Tology', but although simple and easy to pronounce it has no inherent meaning.

The fundamental difficulty seems to be that *herba inutilis* or *noxia*, to give weed its Latin name (allied Fr. *mauvaise herbe* and Sp. *mala hierba/maleza*) doesn't conveniently lend itself to the desired treatment without confusion with 'herb' and 'herbage' in the modern accepted sense. Thus 'herbology', if it were to be coined, would clearly be a better word for the promotion of pasture than the suppression of weeds, notwithstanding that a herbicide is recognized as a weed-killer!

Professor Camargo suggests the word 'Matology', which he offers as a 'well-formed hybrid neologism created by the classical method and whose meaning contains the essence of the study of weed science'. His word is derived from *mato* (Low Latin *mattu*) plus the Greek suffix *logy*, and is supported by various Portuguese lexicographers who cite *matto* as wild plants of small dimensions or uncultivated earth covered by wild plants. *Mato* is apparently also a modern Spanish-Portuguese word widely used for weeds. From this, 'Matonomy' would designate weed control.

A good case has been made out, but the question now is whether there are any other contenders ready to enter the lists. 'Weedology' has gained some currency in English usage—another hybrid deriving from Old Saxon *wiod*, plus the Greek ending—and so has a reputable ancestry. With academic support it could prevail.

AGRIC

Books

Scientific Study Group Report: Beef Improvement. MEAT AND LIVESTOCK COMMISSION, April 1971.

This sixty-three page paperback* contains a fascinating appraisal of the present structure of beef breeding in Britain in its widest sense and proceeds to consider schemes for the improvement of beef cattle.

The terms of reference of the 10-man study group were 'To review the scientific aspects of the Commission's existing and proposed livestock improvement schemes and to consider in the light of the review and other relevant facts what changes, if any, are desirable and to recommend the basis on which livestock improvement work might be developed'.

Future developments with reference to E.E.C. are considered. The subsequent main sections deal with objectives for improvement, techniques, a summary of current recording and improvement schemes, with an analysis of cost effectiveness and genetic improvement programmes.

The report expresses concern at the lack of research in cattle breeding in Britain and urges the M.L.C. to support such research work.

The major recommendation in this context is that the M.L.C. should set up and manage a beef herd and supply bulls to stand at A.I. centres. The herd size should be at least 200 cows with performance testing of all males using a single complete diet in order to measure feed conversion efficiency. The arguments for this proposal are convincing and the potential genetic rewards are assessed.

If the estimated cost of setting up such an experimental herd is accurate, i.e., £160,000 for purchase of farm, buildings and stock and £6,000 for annual costs, this is insignificant when related to the potential reward to British beef production.

The cost effectiveness of this scheme is assessed, computed on the basis of improvement in 400 day weight, and the discounted cash flow analysis makes it look like an attractive financial proposition.

Due weight is given to co-operative schemes with breed societies and individual breeders.

This report is essential reading for anyone with a scientific interest in the breeding of beef cattle. It is comprehensive, represents clear and logical thinking and lets daylight into a subject which has for too long been clouded by breed society prejudice and rule of thumb selection of stock.

**Obtainable free from Meat and Livestock Commission, P.O. Box 44, Queensway House, Bletchley, Buckinghamshire.*

J.A.G.

The Control of Injurious Animals. J. M. CHERRETT, J. B. FORD, I. V. HERBERT AND A. J. PROBERT. English Universities Press, 1971. *£1·65.*

There is today an increasing awareness of the impact made by man on his environment and not least on other animals. This has led to both a world-wide interest in conservation and an appreciation of the economic necessity of controlling populations of animals, including man. The authors of this useful general text-book begin by discussing the concept of a 'pest' —an animal noxious, destructive or troublesome to man or to his interests—and the complexity of calculating the cost to benefit ratio of control measures.

Successful control must have an ecological basis, and much can be achieved by preventing animals from becoming pests; for example by using legislative, physical, chemical or behavioural barriers, or by appropriate crop husbandry. About half of the book is concerned with the technology of pest destruction, by physical, chemical or biological methods, singly or integrated. But there are other chapters on the side effects of pest control and on social and economic considerations.

The control of animal populations involves not only zoology, but often veterinary and human medicine, besides the disciplines of chemistry, physics, mathematics and botany. The need to effect control without unduly disturbing stable ecosystems is recognized, and emphasizes the precision required of control techniques. But world resources are finite and, as the authors conclude, no amount of crop saving by refined pest control will meet the needs of an ever increasing human population with better living standards.

Most of the examples of pests given in the book are invertebrates but the European rabbit is often cited, although no reference is given and the plate of a myxomatous rabbit has no acknowledgment. There is an index, glossary and list of further reading.

H.V.T.

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